

## **APPENDIX IV-B RCRA FACILITY INVESTIGATION (RFI) OUTLINE**

The purpose of the RFI portion of the RCRA corrective action process is to evaluate the nature and extent of releases of hazardous wastes and/or hazardous constituents and to gather necessary data to support the Corrective Measures Study (**CMS**) and/or Interim Measures (**IM**). The Permittee shall accomplish the investigation through the following logical progression of tasks:

1. gather information on the source of the release(s) to the environment (**Source Characterization**),
2. gather information on the physical aspects of the environment which will affect the migration and fate of the release and identification of exposure pathways for both humans and non-human members of the environment (**Environmental Setting**),
3. use Source Characterization and Environmental Setting to develop a conceptual model of the release which will be used to plan and conduct a program to define the nature, rate and extent of the release (**Sampling and Analysis Plan**).

An RFI Work Plan and RFI Report are generally required elements of the RCRA corrective action process. The requirements for a full, detailed RFI are provided in the following paragraphs:

### **I. RFI WORK PLAN REQUIREMENTS - ELEMENTS OF THE RFI WORK PLAN**

The RFI Work Plan shall include, at a minimum, the following elements:

#### **A. Introduction - Summary of any relevant existing assessment data**

The Permittee shall describe the purpose or objective of the RFI Work Plan and provide a summary of any existing environmental data which is relevant to the investigation. The summary should provide the following items, at a minimum:

1. land ownership history,
2. facility operating dates,
3. facility's product(s),
4. raw materials used in facility operations, wastes generated,
5. nature and extent of any known contamination,

6. summary of ongoing Interim Measures and past assessments,
7. summary of permit objective and how this objective will be satisfied.

## **B. Environmental Setting**

The Permittee shall provide information on the environmental setting at the Facility. The Permittee shall characterize the Environmental Setting as it relates to identified sources, pathways and areas of releases of hazardous constituents from Solid Waste Management Units (**SWMUs**) and/or Areas of Concern (**AOCs**). Data gaps pertinent to characterization of releases shall be identified and provisions made in Section E (*Sampling and Analysis Plan for Characterization of Releases of Hazardous Wastes/Hazardous Constituents*) to obtain the relevant information to fill the data gap. The Environmental Setting shall cover the following items, at a minimum:

### **1. Hydrogeology**

The Permittee shall provide a summary of the hydrogeologic conditions at the Facility. This discussion shall include, but not be limited to, the following information:

- a. A description of the regional and local geologic and hydrogeologic characteristics affecting ground-water flow beneath the KAFB's Container Storage Unit (**the CSU**), and any AOC or SWMU listed in Appendix IV-A, including:
  - i) Regional and facility specific stratigraphy: a description of strata including strike and dip, identification of stratigraphic contacts;
  - ii) Structural geology: a description of local and regional structural features (e.g., folding, faulting, tilting, jointing, metamorphic foliation, etc.);
  - iii) Depositional history;
  - iv) Regional and Facility specific ground water flow patterns (porous media, fracture media, karst media); and
  - v) Identification and characterization of areas and amounts of recharge and discharge (springs in karst terrain, base level streams and rivers).

- b. An analysis of any topographic features that might influence the ground water flow system (e.g., sinkholes and sinking streams in karst terrains).
- c. Based on any existing field data, tests (e.g., pump tests, tracer tests), and cores, a representative and accurate classification and description of the hydrogeologic units which may be part of the migration pathways at the facility (i.e., the aquifers and any intervening saturated and unsaturated units), including:
  - i) Hydraulic conductivity and porosity (total and effective), groundwater flow velocity, groundwater basin discharge;
  - ii) Lithology, grain size, sorting, degree of cementation;
  - iii) An interpretation of hydraulic interconnections between saturated zones (i.e., aquifers) and surface waters; and
  - iv) The attenuation capacity and mechanisms of the natural earth materials (e.g., ion exchange capacity, organic carbon content, mineral content, etc.).
- d. Based on data obtained from groundwater monitoring wells and piezometers installed upgradient, water wells downgradient of the potential contaminant source, a representative description of water level or fluid pressure monitoring including:
  - i) Water-level contour and/or potentiometric maps, including seasonal variations;
  - ii) Hydrologic cross sections showing vertical gradients;
  - iii) The flow system, including the vertical and horizontal components of flow; and
  - iv) Any temporal changes in hydraulic gradients, for example, due to tidal or seasonal influences and for karst terrain, storm flow.
- e. A description of man-made influences that may affect the hydrology of the site, identifying:

- i) Local water-supply and production wells with an approximate schedule of pumping; and
- ii) Man-made hydraulic structures (pipelines, french drains, ditches, roofs, runways, parking lots, etc.).

**2. Soils**

The Permittee shall provide an explanation of the soil and rock units above the water table in the vicinity of contaminant release(s). This summary may include, but not be limited to, the following types of information as appropriate:

- i) Surface soil distribution;
- ii) Soil profile, including ASTM classification of soils;
- iii) Transects of soil stratigraphy;
- iv) Hydraulic conductivity (saturated and unsaturated);
- v) Relative permeability;
- vi) Bulk density;
- vii) Porosity;
- viii) Soil sorption capacity;
- ix) Cation exchange capacity (CEC);
- x) Soil organic content;
- xi) Soil pH;
- xii) Particle size distribution;
- xiii) Depth of water table;
- xiv) Moisture content;
- xv) Effect of stratification on unsaturated flow;
- xvi) Infiltration;
- xvii) Evapotranspiration;
- xviii) Storage capacity;
- xix) Vertical flow rate; and
- xx) Mineral content.

**3. Surface Water and Sediment**

The Permittee shall provide a description of the surface water bodies in the vicinity of the Facility. This summary may include, but not be limited to, the following activities and information:

- i) Description of the temporal and permanent surface water bodies including:

- ii) For impoundments: location, elevation, surface area, depth, volume, freeboard, and construction and purpose;
  - iii) For streams, ditches, and channels: location, elevation, flow, velocity, depth, width, seasonal fluctuations, flooding tendencies (i.e., 100 year event), discharge point(s), and general contents.
  - iv) Drainage patterns; and
  - v) Evapotranspiration.
- b. Description of the chemistry of the natural surface water and sediments. This includes determining the pH, total dissolved solids, total suspended solids, biological oxygen demand, alkalinity, conductivity, dissolved oxygen profiles, nutrients, chemical oxygen demand, total organic carbon, specific contaminant concentrations, etc.
- c. Description of sediment characteristics including:
- i) Deposition area;
  - ii) Thickness profile; and
  - iii) Physical and chemical parameters (e.g., grain size, density, organic carbon content, ion exchange capacity, pH, etc.)

#### **4. Air**

The Permittee shall provide information characterizing the climate in the vicinity of the facility. Such information may include, but not be limited to:

- a. A description of the following parameters:
- i) Annual and monthly rainfall averages;
  - ii) Monthly temperature averages and extremes;
  - iii) Wind speed and direction;
  - iv) Relative humidity/dew point;
  - v) Atmospheric pressure;
  - vi) Evaporation data;
  - vii) Development of inversions; and
  - viii) Climate extremes that have been known to occur in the vicinity of the facility, including frequency of occurrence (i.e., Hurricanes)

- b. A description of topographic and man-made features which affect air flow and emission patterns, including:
  - i) Ridges, hills or mountain areas;
  - ii) Canyons or valleys;
  - iii) Surface water bodies (e.g., rivers, lakes, bays, etc.); and
  - iv) Buildings.

**C. Source Characterization**

For those sources from which releases of hazardous constituents have been detected, the Permittee shall provide analytical data to completely characterize the wastes and the areas where wastes have been placed, to the degree that is possible without undue safety risks, including: type, quantity; physical form; disposition (containment or nature of deposits); and facility characteristics affecting release (e. g., facility security, and engineering barriers). Data gaps on source characterization shall be identified and provisions made in Section E (Sampling and Analysis Plan...) to obtain the relevant information to fill the data gap. This summary shall include quantification of the following specific characteristics, at each source area:

1. Unit/Disposal Area Characteristics:

- a. Location of unit/disposal area;
- b. Type of unit/disposal area;
- c. Design features;
- d. Operating practices (past and present)
- e. Period of operation;
- f. Age of unit/disposal area;
- g. General physical conditions; and
- h. Method used to close the unit/disposal area.

2. Waste Characteristics:

- a. Type of wastes placed in the unit;
  - i) Hazardous classification (e. g., flammable, reactive, corrosive, oxidizing or reducing agent);
  - ii) Quantity; and
  - iii) Chemical composition.

- b. Physical and chemical characteristics such as:
  - i) Physical form (solid, liquid, gas);
  - ii) Physical description (e.g., powder, oily sludge);
  - iii) Temperature;
  - iv) pH;
  - v) General chemical class (e.g., acid, base, solvent);
  - vi) Molecular weight;
  - vii) Density;
  - viii) Boiling point;
  - ix) Viscosity;
  - x) Solubility in water;
  - xi) Cohesiveness of the waste; and
  - xii) Vapor pressure.
- c. Migration and dispersal characteristics of the waste such as:
  - i) Sorption capability;
  - ii) Biodegradability, bioconcentration, and biotransformation;
  - iii) Photodegradation rates;
  - iv) Hydrolysis rates; and
  - v) Chemical transformations.

#### **D. Potential Receptors**

The Permittee shall provide data describing the human populations and environmental systems that are susceptible to contaminant exposure from the facility. Data gaps pertinent to receptor analysis shall be identified and provisions made in Section E to obtain the relevant information to fill the data gap. The following characteristics shall be identified at a minimum:

- 1. Current local uses and planned future uses of groundwater:
  - a. Type of use (e.g., drinking water source: municipal or residential, agricultural, domestic/non-potable, and industrial);
  - b. Location of groundwater users, to include withdrawal and discharge wells and springs, within one mile of the impacted area.

The above information should also indicate the aquifer or hydrogeologic unit used and/or impacted for each item.

2. Current local uses and planned future uses of surface waters directly impacted by the Facility:
  - a. Domestic and municipal (e.g., potable and lawn/gardening watering);
  - b. Recreational (e.g., swimming, fishing);
  - c. Agricultural;
  - d. Industrial; and
  - e. Environmental (e.g., fish and wildlife propagation).
3. Human use of or access to the facility and adjacent lands, including but not limited to:
  - a. Recreation;
  - b. Hunting;
  - c. Residential;
  - d. Commercial; and
  - e. Relationship between population locations and prevailing wind direction.
4. A general description of the biota in surface water bodies on, adjacent to, or affected by the Facility.
5. A general description of the ecology within the area adjacent to the Facility.
6. A general demographic profile of the people who use, have access to the Facility and adjacent land, including, but not limited to: age; sex; and sensitive subgroups.
7. A description of any known or documented endangered or threatened species near the Facility.

**E. Sampling and Analysis Plan (SAP) for Characterization of Releases of Hazardous Waste/Hazardous Constituents**

The Permittee shall prepare a plan to document all monitoring procedures necessary to characterize the extent, fate and transport of releases (i.e., identify sample locations, sample procedures and sample analysis to be performed during the investigation to characterize the environmental setting, source, and releases of hazardous constituents, so as to ensure that all information and data are valid and properly documented). The



sampling strategy and procedures shall be in accordance with EPA Region 4 Environmental Compliance Branch's Standard Operating Procedure and Quality Assurance Manual (SOP) (most recent version). Any deviations from this reference must be requested by the Permittee and approved by NMED. If a Risk Assessment is expected to be performed once release characterization is complete or nearly complete, Data Quality Objectives (**DQO**) for a Human Health Risk Assessment requires a Data Quality Objective of Level 3 or greater.

The Sampling and Analysis Plan must specifically discuss the following unless the SOP procedures are specifically referenced.

1. Sampling Strategy

- a. Selecting appropriate sampling locations, depths, etc.;
- b. Obtaining all necessary ancillary data;
- c. Determining conditions under which sampling should be conducted;
- d. Determining which media are to be sampled (e.g., groundwater, air, soil, sediment, subsurface gas);
- e. Determining which parameters are to be measured and where;
- f. Selecting the frequency of sampling and length of sampling period;
- g. Selecting the types of samples (e.g., composite vs. grab) and the number of samples to be collected.

2. Sampling Procedures

- a. Documenting field sampling operations and procedures, including:
  - i) Documentation of procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., filters, preservatives, and absorbing reagents);
  - ii) Procedures and forms for recording the exact location and specific considerations associated with sample acquisition;
  - iii) Documentation of specific sample preservation method;
  - iv) Calibration of field instruments;

- v) Submission of appropriate blanks (e.g., field, equipment, trip, etc.);
  - vi) Potential interferences present at the Facility;
  - vii) Construction materials and techniques, associated with monitoring wells and piezometers;
  - viii) Field equipment listing and sampling containers;
  - ix) Sampling order; and
  - x) Decontamination procedures.
- b. Selecting appropriate sample containers;
  - c. Sampling preservation; and
  - d. Chain-of-custody, including:
    - i) Standardized field tracking reporting forms to establish sample custody in the field prior to shipment; and
    - ii) Pre-prepared sample labels containing all information necessary for effective sample tracking.
    - iii) Chain-of-custody seals for sample containers and shipping coolers.

### 3. Sample Analysis

Sample analysis shall be conducted in accordance with the most recent version of SW-846: "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods" or an alternate method approved by NMED. The sample analysis section of the Sampling and Analysis Plan shall specify the following:

- a. Chain-of-custody procedures, including:
  - i) Identification of a responsible party to act as sampling custodian at the laboratory facility authorized to sign for incoming field samples, obtain documents of shipment, and verify the data entered onto the sample custody records;
  - ii) Provision for a laboratory sample custody log consisting of serially numbered standard lab-tracking report sheets; and
  - iii) Specification of laboratory sample custody procedures for sample handling, storage, and disbursement for analysis.

- b. Sample storage (e.g., maximum holding times for constituents);
- c. Sample preparation methods;
- d. Analytical Procedures, including:
  - i) Scope and application of the procedure;
  - ii) Sample matrix;
  - iii) Potential interferences;
  - iv) Precision and accuracy of the methodology; and
  - v) Method Detection Limits; and
  - vi) Practical Quantitative Limits
- e. Calibration procedures and frequency;
- f. Data reduction, validation and reporting;
- g. Internal quality control checks, laboratory performance and systems audits and frequency, including:
  - i) Method blank(s);
  - ii) Laboratory control sample(s);
  - iii) Calibration check sample(s);
  - iv) Replicate sample(s);
  - v) Matrix-spiked sample(s);
  - vi) "Blind" quality control sample(s);
  - vii) Control charts;
  - viii) Surrogate samples;
  - ix) Zero and span gases; and
  - x) Reagent quality control checks.
- h. External quality control checks by NMED, including:
  - i) Spikes and blanks at sampling events for which NMED or its technical representative provides oversight; and
  - ii) The equivalent of a CLP data package for samples split with NMED or for which NMED specifically requests the package.
- i. Preventive maintenance procedures and schedules;
- j. Corrective action (for laboratory problems); and

- k. Turnaround time.

## **F. Data Management Plan**

The Permittee shall develop and initiate a Data Management Plan to document and track investigation data and results. This plan shall identify and set up data documentation materials and procedures, project file requirements, and project-related progress reporting procedures and documents. The plan shall also provide the format to be used to present the raw data and conclusions of the investigation.

### **1. Data Record**

The data record shall include the following:

- a. Unique sample or field measurement code;
- b. Sampling or field measurement location and sample or measurement type;
- c. Sampling or field measurement raw data;
- d. Laboratory analysis identification number;
- e. Property or component measures; and
- f. Result of analysis (e.g. concentration, data qualifiers).

### **2. Tabular Displays**

The following data shall be presented in tabular displays:

- a. Unsorted (raw) data;
- b. Results for each medium, or for each constituent monitored;
- c. Data reduction for statistical analysis, as appropriate;
- d. Sorting of data by potential stratification factors (e.g., location, soil layer, topography); and
- e. Summary data

### **3. Graphical Displays**

The following data shall be presented in graphical formats (e.g., bar graphs, line graphs, area or plan maps, isopleth plots, cross-sectional plots or transects, three dimensional graphs, etc.):

- a. Sampling location and sampling grid:

- b. Indicate boundaries of sampling area, and area where more data are required;
- c. Display geographical extent of contamination, both horizontally and vertically;
- d. Illustrate changes in concentration in relation to distances from the source, time, depth or other parameters; and
- e. Indicate features affecting inter-media transport and show potential receptors.

**G. Project Management Plan - Schedule of Implementation**

Permittee shall prepare a Project Management Plan which will cover qualifications of personnel categories and the management control structure for the project. The Permittee shall also provide a schedule for completing the planned RFI activities. The schedule shall be as specific as possible (i.e., it should indicate the number of days/weeks/months required for each major work plan task).

**II. RFI REPORT REQUIREMENTS - ELEMENTS OF THE RFI REPORT**

The RFI Report shall include, at a minimum, the following elements:

**A. Introduction**

The Permittee shall describe the purpose of the RFI Work Plan and provide a summary description of the project.

**B. Environmental Setting**

The Permittee shall describe the Environmental Setting in and around the Facility. The RFI Work Plan shall contain some, if not all, of the information on the Environmental Setting. Any information collected during work plan implementation which clarifies or improves understanding of the Environmental Setting should be provided in this section.

**C. Source Characterization**

The Permittee shall summarize the sources of contamination and nature of releases identified at the Facility. The RCRA Facility Assessment and the RFI Work Plan shall contain some, if not all, of the information on Source Characterization. Any information collected during work plan implementation or obtained from the sources (e.g., voluntarily or from other Environmental Programs) which directly addresses Source Characterization should be provided in this section.

**D. Sampling and Analysis Results**

The Permittee shall present data results obtained pursuant to the RFI Work Plan. The Permittee shall identify any work plan proposals which were not completed and explain why such actions were not finished. The Permittee shall also present his analysis/interpretation of how the sampling data meet the RFI objective and how the sampling data fits or modifies the contaminant conceptual model. For all analytical data, the Permittee shall discuss the results of data quality/data review.

**E. Data Quality Assurance/Data Quality Control Review**

The Permittee shall perform a Quality Assurance/Quality Control (QA/QC) data review on all data present in the RFI. The QA/QC data review shall be in accordance with the U.S. EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA-540/R94-013)* and the U.S. EPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA-540/R94-012)*. The data review shall address the following, at a minimum:

- a. Holding times;
- b. Blanks;
- c. Laboratory Control Samples;
- d. Field Duplicates;
- e. Surrogate Recoveries;
- f. Matrix Spike/Matrix Spike Duplicates
- g. Data Assessment - Data Usability.

**F. Conclusions**

The Permittee shall summarize the major conclusions reached after analysis of the environmental setting, source characterization, sampling and analysis results and data quality. Any data gaps, needed to complete characterization of the scope and extent of the releases from SWMUs and/or AOCs or to refine further the contaminant conceptual model, shall be identified and recommendations made in the Recommendations Section of the report.

**G. Recommendations**

The Permittee shall provide his recommendations on what, if any, further action is needed to complete the characterization of release(s) from SWMUs and/or AOCs.

#### **H. Work Plan for Additional Investigations**

If further investigations are determined to be needed to complete the objective of the RFI, then the Permittee shall provide a work plan to complete characterization of the release(s).

### **III. DETERMINATION OF NO FURTHER ACTION (NFA)**

1. Based on the results of the RFI and other relevant information, the Permittee may submit an application to NMED for a Class III Permit modification under 20.4.1.900 NMAC, incorporating 40 CFR 270.42 (c) to terminate the RFI/CMS process for a specific unit. This permit modification application must contain information demonstrating that there are no releases of hazardous wastes or hazardous constituents from a particular SWMU/AOC at the facility that poses a threat to human health and the environment, as well as information required in 20.4.1.900 NMAC, incorporating 40 CFR 270.42 (c), which incorporates by reference 40 CFR 270.13 through 270.21, 270.62, and 260.63. If, based upon review of the Permittee's request for a permit modification, the results of the RFI, and other information, including comments received during the sixty (60) day public comment period required for Class III permit modifications, NMED determines that releases or suspected releases which were investigated either are non-existent or do not pose a threat to human health and the environment, NMED will grant the requested modification. [See Appendix IV-E for NFA Criteria].
2. A determination of no further action shall not preclude the Administrative Authority from requiring continued or periodic monitoring of air, soil, ground water, or surface water, when site-specific circumstances indicate that release of hazardous wastes including hazardous constituents are likely to occur, if necessary to protect human health and the environment.
3. A determination of no further action shall not preclude NMED from requiring further investigations, studies, or remediation at a later date, if new information or subsequent analysis indicates a release or likelihood of a release from a SWMU at the facility that is likely to pose a threat to human health or the environment. In such case, the Administrative Authority may initiate either a modification to the Corrective Action Module of this Permit according to procedures in this Permit, or a major permit modification according to 20.4.1.900 NMAC, incorporating 40 CFR 270.41, to rescind the determination made in accordance with Permit Condition III.